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A

REGISTER OF EXPERIMENTS

ANATOMICAL, PHYSIOLOGICAL, & PATHOLOGICAL,

PERFORMED

ON LIVING ANIMALS,

BY

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METHOD OF SHOEING."

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ADVERTISEMENT.

THE few following pages contain the description of an unique experiment as repeated upon the bloodvessels of living animals; together with results which consist of the development of some new facts, so important and startling in the contemplation of the phenomena of animal life, that, in the humble opinion of the Author, they constitute an entire new field for inquiry, worthy the research and scrutiny of the human physiologist, having the same reference to the structure and economy of man as to inferior animals.

*Horse Infirmary, 311, Regent Street,
London, April 1839.*

TO THE MEDICAL PROFESSION.

THE presumption of an individual so obscure as the writer of these pages soliciting the time and attention (though merely a passing notice) of a body of men constituting a scientific class of the community, justly acknowledged the most learned, the most wise, and at the same time the most useful to mankind at large, impresses me with a deep sense of the magnitude of my task, though it deters me not from the undertaking.

Notwithstanding the confidence expressed in my advertisement, I feel that I cannot reasonably expect to excite your attention and interest without respectfully placing before you some of my pretensions for having embarked in so bold a procedure; but, aware of the immense value of your time, it behoves me to be brief.

I must premise, that I commenced active prac-

tice as veterinary surgeon in the British cavalry when a youth of nineteen, and continued attached to the same regiment until after the close of the Peninsular war. My military appointment afforded me many years of valuable experience, and being upon the home service, I also enjoyed very extensive private practice. From thence to the present hour my time has been wholly devoted to the practical part of the veterinary profession, fostered by an ardent love for it, and blessed with undisturbed rude health throughout that lengthened period. I have never been an absentee from the pursuit for one whole week; and all my intervals of leisure have been devoted to theory and experiment. My opportunities for experiments have been so numerous and varied, that I blush with shame at not having produced earlier and better fruits. I have, however, availed myself of some; and if fortunate enough, through your candour, to bring a tithe part of them to a successful issue, my ambition will be gratified, and I shall not regret the labour I have bestowed; and more, that, whether successful or not in this

Essay, I shall persist in experimental inquiries, and ere long again appeal to you for a second hearing.

The few brief remarks which I have to make upon the veterinary profession generally I hope you will tolerate, otherwise I fear of convincing you that, as a body of men engaged in a pursuit although inferior yet not dissimilar to your own, we possess many facilities to aid us in prying into some of the hidden secrets of Nature which are denied to your own class.

It is well known that veterinary science has flourished in this country, under the new and improved system as emanated from the Royal Veterinary College, for nearly the last half century. Talented members of the profession have favoured the public with elaborate works upon the anatomy, physiology, and pathology of the horse, which will ever reflect credit upon their authors and the age in which they were written.

The veterinary art has recently been condescendingly styled by the giants of human surgery the "sister science;" and our venerable and talented Professor Coleman inculcates the necessity

of his students cultivating a respectful acquaintance with the surgeons of the district where they may be located ; but I trust I may be allowed to add, for the honour of the profession of which I am a humble member, that the day is now arrived when the medical man no longer walks into the infirmary of horses to *dictate*, but merely for the pleasure both of giving and receiving professional information with that animus which ought ever to subsist between brothers engaged in kindred sciences.

I think I perceive that veterinary writers of the new school, with one or two highly creditable exceptions, have principally devoted themselves to the physiology of quadrupeds exclusively : my humble efforts will be directed in the same channel, except that it will be my design to concentrate my feeble powers and experience by selecting subjects that may gain for me your encouragement and approbation, as being equally applicable to the human frame.

Two generations of veterinary men may now be said to have appeared before the public upon

the basis of a medical education and scientific principles combined ; and Professor Coleman, the veterinary surgeon in chief of Her Majesty's cavalry, through the influence of his successful professional career, and backed by his gentlemanly deportment, having many years ago procured for cavalry veterinary surgeons the rank of commissioned officers from his late Majesty George the Fourth, all respectable veterinary surgeons, whether in the army or not, *claim* a station in society to which before that consummation they had, perhaps, *aspired*, but which can now no longer in fairness be withheld from them.

I take this occasion, but with the utmost deference, to hint to the medical profession that an intercourse with the veterinarian somewhat more social would be duly appreciated by him ; and, I will venture to add, would contribute greatly towards the ends of science.

The operating and scientific veterinarian, in some points of view, may be regarded as enjoying facilities for the zealous prosecution of physiolo-

gical research, perhaps even greater and more frequent than yourselves.

Although precision and dexterity are essentials to the success of our chief or major operations, yet their rapid execution is not indispensable, as in the human patient, where its prolongation adds terrors an hundred fold to the already excited nervous system. In the intervals between the struggles of our patients, just in proportion as the operator possesses a philosophical mind, will curious phenomena present themselves to or rather be forced upon his notice within the lesions, and such as he may have never heard or read of in books.

As we emerge from our leading-strings, and aided by all these advantages, the public, and the medical profession in particular, have a just right to expect from our researches the contribution of an occasional mite towards extending the limits of anatomical, physiological, and pathological knowledge as applicable to the human frame.

By the exercise of one remedy alone, viz. the actual cautery, I have enjoyed almost daily, for

years, an insight into the mechanism of the circulation in minute bloodvessels, such as cannot, by possibility, have met the eye of human surgeons when practising upon their fellow-creatures; and I feel very much inclined to assume, that few, even of the most practical veterinarians, have been indulged with the like inspection of the movement of the living bloodvessels. My reasons for such supposed exclusiveness are, First, the human surgeon penetrates to the seat of disease invariably by an incision through the skin or common integuments by a scalpel, or cold steel in some shape or other; *blood* necessarily follows; and hence a physiological view of the circulation within the vessels is veiled from his sight. On the contrary, in my operations upon horses by cautery lesions, for the removal of chronic lamenesses, consisting of thickened ligaments, tendons, and especially spavin, this last disease being a chronic tumour upon the hock joint, I invariably make an incision through the skin in its centre, from top to bottom. This is also effected by a steel instrument with a knife-like edge, but, observe, *red hot!* The in-

stant the skin is severed, a considerable dilatation of the lips of the wound ensues, the tumour is exposed to view, and, in three instances out of four, without the escape of a single drop of blood, or stain sufficient to soil a white handkerchief, and notwithstanding the horse's hide at this part is very thick; the subcutaneous tissues continue for the space of several minutes, presenting a most interesting spectacle to the inquiring physiologist as regards the smaller bloodvessel system. Secondly, that veterinarians, generally speaking, do not practise these deep cautery lesions.

The cellular membrane and fasciæ have an aspect delicately white, upon the surface of which is to be seen a beautiful network of bloodvessels, highly injected, forming a complete arborization, the skin having receded without affecting their integrity, and the efflux of blood from the highly vascular skin itself being most effectually prevented by the sealing effect of the cautery.

Gentlemen, anxiously soliciting for my humble endeavours the utmost stretch of your candour, and the exercise of your kindest feelings, my

first essay will be upon the Blood, *as found contained in the living vessels—more especially the arterial system.*

I shall now address a few words to the humane, which, however, are not dictated by any feelings of resistance to their laudable sensitiveness for the protection of the brute creation.

As before stated, I have been occupied the greater part of my life in surgically operating upon the horse, and, perhaps, severely, but with the honest view of rendering the animal serviceable to the owner; and I fearlessly and conscientiously avow, without any remorse; yet in every instance, and I confess they have been numerous, that I have been tempted or warranted in operating *experimentally*, a thrilling of my nerves has invariably been an attendant, and oftentimes I have abandoned my purpose in consequence.

I merely mention this to shew that I am not devoid of feeling; and that, unless the object

sought is otherwise unattainable, or of such paramount importance as to seem to give me a moral right, I never use nor encourage the employment of the scalpel.

ON THE BLOOD.

THE precious life-blood, that fluid so often referred to in holy writ, must have arrested man's attention, when in his earliest and rudest condition, upon beholding the fatal consequences to animal life when spilled from its vessels. Doubtless he marvelled much; and we have it upon record that, from the first dawn of science the most learned men devoted themselves to the contemplation of the phenomena of this important fluid and its vessels; and the investigation appears to have been followed up by every succession of sages down to the periods of our immortal countrymen, Harvey and Hunter.

The latter, in addition to his own discoveries, having proclaimed those upon the blood of his predecessor Harvey to be just and well founded, an overwhelming effect has been produced, and which has continued unabated throughout Europe

for the last fifty years, the result of the joint labours of these two never tiring physiologists.

John Hunter's professional deeds, which justly obtained for him the admiration of all the scientific world, instead of being the offspring of an imaginative genius, that by flying leaps had pounced down upon numberless important discoveries, were, in truth, the valuable *creation* of an intellectual slave, if I may be allowed such a phrase.

Conviction reached home to the minds of his cotemporaries and lookers-on as to the truth of his doctrines, because they beheld with admiration his Herculean labours, and perceived the print of his foot upon every round of the ladder of Fame before he reached its top: the whole world echoed in affixing the stamp of truth upon *all* his writings; and if ever man had a right to be deemed an oracle by his fellow man, it was John Hunter.

Now, let us reflect for a moment upon the consequences of this unbounded confidence reposed in the doings of a single individual. They have been almost hallowed—they have been deemed by succeeding writers sufficiently sound, both as to

quantity and quality, to have formed for them the basis of a stupendous superstructure, a more huge pile of physiological and pathological gleanings, perhaps, the world has never before seen accumulated.

If there has been a fatal error committed by his followers through their sweeping credulity in too general an adoption of his doctrines, it is no reflection upon the great man from whom they have abstracted so much. They should have exercised more discrimination: nine out of ten of his multifarious propositions are manifest advances in physiological science, and, as before said, the route by which they were arrived at was simply and plainly laid open. The truth is, that the great Hunter in his glorious pursuit accumulated such a huge mass of facts before unknown to the scientific world, that even his theories have been held in greater veneration than plain important discoveries, the offspring of more humble individuals.

Now, as John Hunter was but a man, although one of no common order, it is just possible that

he may have been in error as to one or more of his great fundamental principles regarding the blood, which he most prized when he broached his great theory of the vitality of the blood, the causes of its coagulation, &c. I doubt not for a moment but he sincerely believed in its truth. But mark the caution of this rigid observer of facts, wherein he makes this exclamation,—“To conceive that blood is endowed with life while circulating, is, perhaps, carrying the imagination as far as it can well go.”

Those who have been in the habit of perusing the standard physiological works of our own countrymen as they have appeared during the last fifteen or twenty years, and which have not been few nor poor, must have been forcibly struck by the extraordinary manner in which their authors have all harmonized with each other in regard to the attributes of the blood; viz. its circulation, uses, life, coagulation, separation, constituents, &c.; this harmony continuing to the present hour, as if inviolable, except by the occasional advances of the philosophical chymist, who disdains to

notice it at the *fountain*, but wrangles about some elementary atom which his skill may have separated through the agency of some chemical attraction perhaps unknown on the day before. But, notwithstanding the additional lights of chemistry upon the blood have been important, still the theories as to its physiology, circulation, and coagulation remain unchanged.

Now, when I confess to my readers, that I propose not in this section of my work to question the validity of this universally received doctrine of the blood, except so far as I may shew the possibility of investigating the character, properties, motion, &c. of this interesting fluid *while contained in the natural state within its living vessels*, it will be obvious to the reader that I am released from the onus of an elaborate dissertation upon the blood generally, and that I may confine myself to an exposition of the characteristics of that fluid while traversing its natural channels with the perfect integrity of the vessels and health of the animal. In attempting to carry out this object,

I am buoyed up with the vanity of believing, that I have hit upon an expedient which will test the qualities and motion of this mysterious fluid after a manner heretofore unknown.

Heretical scepticism as to some of the Hunterian doctrines of the blood having possessed my mind, I resolved upon tracing with jealous scrutiny the several operations and experiments combined which had conspired to form in John Hunter's mind those opinions upon the blood which have proved so popular to this hour, having passed current for half a century and upwards.

I soon conceived an utter dissatisfaction as to the manner in which that great authority had conducted his chief *experiments* upon the living animal, with the view of testing that important property of the blood called coagulation ; because I fancied I could perceive that the anxious object of his search eluded his mighty grasp, giant as he unquestionably was.

I then quitted the great Hunter for a season, repaired to Harvey, and followed his experi-

ments seriatim upon the living animal, and in vain did I seek for proof positive, even in this high quarter.

Not stopping here, but consulting the medical works of the living stars of this unrivalled metropolis, without beholding Nature duly reflected from their mirror, as regards one section of their labours, viz. the physiology of the blood, my peculiar views being at variance with the prevailing theory, misgivings gathering daily in my mind, I resolved (considering myself something beyond a tyro) on marking out my own path into the living domains of Nature.

But as victim upon victim would be necessarily involved in this undertaking, I paused, deliberated, studied, and, I hope, with Christian feeling, upon the least possible amount of animal suffering. I then applied myself to the invention of a mechanical apparatus, the instantaneous spring of which I intended should seize within a barrel about an inch and a half in length, or more, of either of the larger arteries which might be preferred (the carotid for instance), of any living healthy animal,

the machine being so constructed that each extremity of the barrel or spring clasp should act simultaneously in the constriction of the denuded artery. The reader will now, I trust, be prepared to allow me to utter my protest against the old mode of exploring the contents of living arteries.

I mean to contend, that the process hitherto employed has been *too slow to have been certain*, and that the experimenters have been deluded. Even the indefatigable Hunter lost the race when he undertook to imprison the vital current in its normal condition within the living vessels.

A more subtle fluid in the natural state of the animal traverses his arteries than has been dreamed of by physiologists of the two last centuries; and I flatter myself that I am in a condition to maintain this bold position by actual demonstration.

I shall commence my exposition by quoting John Hunter's own words in his memorable Treatise on the Blood, vide page 14 :—"The frequent recourse which is had to the lancet in diseases, has afforded the most ample opportunities of ob-

servation, almost sufficient to explain *every principle in the blood*, without the aid of further experiment."

At page 17, "There is, I think, more to be learned of the use of the blood in the animal economy from its coagulation than from its fluidity."

From these passages it must, I think, be inferred, that Hunter's theory of the blood was founded chiefly upon his observation and experience of that fluid *when removed from its vessels*.

Now, let us inquire how he conducted some of the most important of his experiments. He says, at page 65, "I laid bare the carotid artery of a living dog, for about two inches in length; I then tied a thread round it at each end, leaving a space of two inches in length between each ligature filled with blood; the external wound was stitched loosely up. Several hours after I opened the stitches, and observed in this vessel that the blood was coagulated, and of a dark colour, the same as in the vein!"

This is strictly true; many of us have found

the same result ; and I believe the same will always be found, provided the experiment be conducted as described above.

The phenomena exhibited, such as the coagulated state of the blood, and its dark colour, being strictly in accordance with Hunter's expectations, both in theory and practice, this great observer was lulled into the delusive hope, that he had exhibited a fair sample of the same identical blood of which the volume was composed.

Now, I make bold to deny the truth of these positions ; and I undertake, by the sudden seizure of an inch and a half of the carotid artery of a living animal, to cause an *instantaneous imprisonment* of its contents in their transit, and that, by the result of this momentary isolation of the arterial trunk and its contents, no men will be more astounded than the admirers and faithful followers of the late John Hunter.

With the utmost complacency and conviction of mind did he contemplate the *circulation, life,* and *death* of this mysterious *fluid*.

EXPERIMENT I.

A horse, eleven years old, in fair condition, about fifteen hands two inches high, three parts bred, was cast. A longitudinal incision of about three inches in length was made in his neck, on the off side, in the direction of the carotid artery, and deepened with the greatest caution, to avoid an unnecessary flow of blood from the capillaries, till about an inch and a half of the trunk of this artery was denuded. On being exposed to view, its pulsation was distinctly felt.

Very little blood had escaped up to this stage of the operation ; and during the time occupied in pulsing the artery the bleeding quite ceased from the minute vessels. The connexion of the artery by its cellular tissue to the surrounding parts having been removed to a length corresponding to the contemplated embrace of the instrument, my newly invented apparatus was now placed under the carotid, the artery pulsating strongly, and the instrument seized the vessel instantaneously, to my entire satisfaction.

At this juncture the operator and patient may both safely have a few moments' respite: the object sought after is isolated, and securely locked up within a case, the calibre of which being sufficiently ample to avoid the slightest compression of the imprisoned artery, except at both extremities, which are hermetically sealed by the sudden constriction of the instrument. Ligatures were now passed round both ends of the carotid, above and below the machine employed.

Without further delay the apparatus with its contents was detached from the living animal by severing the carotid artery with a pair of scissars, as closely as possible to each extremity of the instrument. The external wound having been closed by two or three sutures, nothing remained to be done but to release the animal from the ropes.

Although my curiosity was excited to the utmost stretch to unlock the casket and view the contents immediately, I refrained, but placed it in a medium temperature, and stationary, until four hours had elapsed from the moment of the incarceration of the artery.

*Examination of the Contents of the detached portion
of the Artery.*

Without pretending to anticipate whether the vessel contained any thing or not, I fortunately had the precaution to place it upon a dish. One extremity of the artery was now opened by slackening the instrument, and a small quantity of fluid instantly escaped with a slight jet. The stream was minute and momentary, of a bright scarlet colour, and of remarkable tenuity, and was dispersed in a splash over the surface of a small dish, appearing at the moment homogeneous, but it instantly separated into two distinct parts, red particles (I do not say, globules) and a transparent liquid, thin and almost colourless, exactly resembling condensed vapour. The red particles did not float, but gravitated.

Of course, I most anxiously watched this interesting fluid, thinking it might be fibrin in solution, or held in suspension; but, strange to say, no part formed into a clot—no jellying—no solidification; not a particle would adhere to a pin's

point, or even to its head. I then slit open the artery, and found it perfectly empty, not omitting to examine most minutely the parietes of the artery at each end, which had encountered the instantaneous grasp of the instrument; but not a particle of *congealed* blood was imprisoned even there.

Now, to return to the red particles as they appeared to the unassisted eye, and I do not pretend at present to offer a microscopic description; in fact, I am much at a loss how to describe these bodies. They were of a florid, crimson hue, and very much resembled, in shape and size, the sediment of old port wine, as it appears at the bottom of a wine-glass after receiving the drainings of the last drops from the bottle; but of a brighter red colour.

Here arises a vital question. Was this blood? I answer, that it was *not*, according to the general acceptation of that word. But before it can be pronounced what it was, a phalanx of talent must be energetically employed—a new system of investigation must be instituted—the researches of

the chymist, in conjunction with the most dexterous, patient, and industrious anatomists, aided by the microscopic field ; and when all these lights have been brought to bear, we may, perhaps, be reluctantly driven back to the reconsideration of the theory of the ancients.

Startled by the result of my first experiment, I began to ask myself whether, like hundreds of others now silent in their graves, who had indulged in prying into Nature's secrets, I had added another deluded mortal to that number, yet eagerly clinging to the vain hope that I had struck into a new track towards the development of some great physiological truth.

I reasoned with myself thus :—If I have stolen a march, and approached somewhat nearer a great secret, that which I have obtained from a living carotid was procured under circumstances of great outrage to the organization of the parts concerned, and to the vascular system generally, how can I or any other human being tell but the mere circumstance of exposing the external surface of so large and important a vessel to the impression

of the atmospheric air, independent of and prior to the rude application of an instrument, may have instantly revolutionized its contents, and subverted the action of the organ.

Now, in telling the *truth*, and not withholding the *whole truth*, I found that the arterial trunk pulsed energetically in proportion to the exposure and degree of irritation to which it was subjected *prior* to the seizure by the apparatus.

With these reflections, therefore, I considered my experiment anything but conclusive, and immediately resolved upon another, by which I should carry the same thing out under very different circumstances.

It occurred to me, that I would make a seizure with my instrument of the spermatic artery of a living animal, because every facility might be afforded for the effectual embrace of the vessel without the artery being denuded, exposed to the air, or even the actual contact of the instrument, plenty of cellular tissue being interposed.

EXPERIMENT II.

A fine healthy stallion ass was procured, five years old, vigorous, full of flesh, and from hard work. He was cast: his testicles were well developed.

An incision was carefully made in the scrotum, to allow the left testicle to escape from its capsule without wounding that organ or its spermatic chord.

Several inches above the epididymus a small puncture was made through the chord lengthways, but only in the slight connecting medium between the bloodvessels and the vas deferens, a transparent cellular tissue, thin as gauze, and bloodless, merely for the passage of the instrument, that it might encompass artery and vein without including the vas deferens in the gripe.

The spring apparatus having performed its office effectually, it was immediately detached, with the testicle appended to it, and the animal was allowed to get up, retaining the other testicle for a future experiment.

After much reflection upon this case, I feel inclined to believe that the spermatic artery and contents were instantaneously enclosed while in their normal condition.

1st. The coats of the artery had not been one moment exposed to the atmospheric air, as was the case in the carotid experiment.

2d. During its compression the instrument never touched the vessel, all the other tissues of the chord being interposed.

3d. Not a particle of blood or substance had been removed from the chord ; it was entire, except the very trivial perforation above described, through a part which was transparent from its thinness.

The imprisoned portion of the spermatic artery was about two inches in length, and as, in the former experiment of the carotid, it was not opened and examined until after the lapse of four hours : it yielded precisely the same result, but the quantity of the fluid was very small.

EXPERIMENT III.

The external submaxillary artery in the horse is a vessel of considerable calibre, considering its superficial situation where it passes over the lower jaw bone; and the veterinarian being so familiar with it, as affording the most convenient part for feeling the pulse, I was tempted to explore its contents, but more particularly from the facility of exposing it to view with so little previous dissection.

A healthy ass was cast, an incision in the skin of about three inches in length was made in the jaw of the off side, in the direction of the artery, commencing exactly where this vessel crosses the jaw bone, and continued upward towards the face; nearly an inch and a half of that portion of the artery was exposed to view which was believed to send off little or no branches.

The duct of the parotid gland being so contiguous to the artery at this part, it was decided not to separate them, to avoid unnecessary expo-

sure of the bloodvessel. The apparatus was then applied, and it effectually embraced both trunks.

Ligatures were then applied to the artery and the duct, and the animal was released.

This artery and its contents were examined within *three* hours after the operation, with the same results, and not a particle of clotted blood or coagulum could be found.

Having announced in detail the foregoing facts, which have resulted from repeated dissections of the living animal, I do not hesitate to avow, that I think John Hunter was wrong, wherein he states at page 17, as before quoted, “*that more is to be learned of the use of the blood in the animal economy from its coagulation than from its fluidity.*”

As a sceptic of the Hunterian and Harveian doctrines, I here take my stand. But there are luminaries of the present day guided mainly in their decision upon all the phenomena of the blood, its physiology, pathology, &c. by its coagulating power, by the presence of fibrin as to quantity and quality.

If we turn to our neighbours on the continent,

we find that indefatigable French philosopher, Magendie, absolutely absorbed by the subject, vide his invaluable lectures in the "*Lancet*."

This model of a teacher of animal organization, who wisely rejects every theory which is found to quail under the test of experimental inquiry,—even this cautious inquirer, this just critic upon a huge pile of groundless theories, with the utmost complacency experiments upon the clot of blood recently abstracted by ordinary blood-letting from his patients (to use his own words), from the temporal artery, for instance, and then expatiates upon the quality and quantity of the fibrin it contains, as though he imagined that cup of arterial blood to have been a fair specimen of the fluid which was traversing that vessel the instant before he plunged in his lancet, and opened a communication between its cavity and the surrounding atmosphere.

This extrication of invisible gas, or rather *blood steam*, from the aperture in the artery, appears to have been known to the Greek physicians of olden time; but that dazzling theory of the mo-

derns, the "vitality of the blood," has so amused the sages of the last century or two, as to have dispelled all reflection upon that notable fact duly noted by our forefathers.

But modern authors and lecturers have built so largely, have raised such an immense superstructure upon Harvey and Hunter's groundwork, and all its machinery having hitherto worked well, seemingly down to our own time, in all probability the present generation will combine heart and hand in underpinning and vamping up this breach in the foundation, as disclosed by the foregoing experiments upon the bloodvessel system of living animals.

EXPERIMENT IV.

A muscular blood stallion, eight years old, fifteen hands and three inches high, vigorous, and in working condition, was cast and secured in the ordinary way for castration: the testicles were large and sound. The scrotum was opened by the scalpel with especial care, to permit the

escape of the testicles without wounding or in the slightest degree impairing the integrity of those organs. My new apparatus before mentioned was applied to the spermatic chord above the epididymus, encircling the entire rope. At the will of the operator the instrument causes an *instantaneous compression* or ligature of all the bloodvessels of the chord connected with the organ. This large vascular gland is isolated in a twinkling, and the contents of its bloodvessel tissue may be fairly considered imprisoned suddenly while in their normal condition; and, in order that no communication might be opened between them and the atmosphere while they retained any animal heat, the testicles were allowed to remain appended to the animal for about twelve hours before they were cut off; and during their excision every drop of fluid which escaped was carefully collected.

Then immediately followed a most tedious and patient dissection of the testicle, commencing by unravelling the convolutions of the vessels of the

chord, and tracing their branches until lost in the body of the testicle.

After laying open the bloodvessel tissues from end to end, and finding them to contain a dark red fluid, shall I be believed when I declare, that they were devoid of a particle of clot—I mean, of congealed or coagulated blood?

From the following experiment upon the contents of living bloodvessels, an opposite result was produced.

EXPERIMENT V.

A healthy middle-sized horse, seven years old, in good flesh, was chosen, having a good tail, that is, his dock entire, and abundantly supplied with hair, was prepared for the operation of docking in the common way. The tail was amputated rather high up with the ordinary docking machine, and it was severed instantaneously.

It was my design to trace the contents of the bloodvessels of the detached portion, as I had before done of the testicle.

Accordingly, while an assistant was amputating the tail, I had a firm grasp with my hand upon that portion which was to come off, having it held in that direction that its wounded surface would be the most elevated at the moment of excision, thereby preventing more than a single drop or two of blood falling from it to the ground. Upon a very attentive and immediate examination of this raw surface remaining uppermost in my hand, instead of its becoming coated or sealed over with a clot of congealed or coagulated blood, I found that, in a few seconds, a transparent lymph accumulated, and covered the entire surface, and which remained a perfectly thin fluid after the lapse of several minutes, and that a few particles of red blood in patches might be seen through this transparent fluid, oozing from the mouths of two or three principal vessels.

In this elevated position I secured the stump, and left it in a temperature of about sixty degrees for nearly three hours, when I returned for my dissection and tracing of the bloodvessels.

The greater part of the transparent lymph had

evaporated or disappeared, but had not coagulated. In this case I was spared the trouble of a minute dissection; for the moment I inspected the mouths of the principal vessels, I found each completely plugged with red coagulated blood, so fibrinous and tenacious, that I was enabled to pull out strings of blood some inches in length from one or two of the principal trunks. Whereas, in the dissection of the testicle there was nothing like so much clotted blood to be found in the entire organ as commonly escapes in the space of two minutes from a man's chin in accidentally shaving off a pimple.

CONCLUDING OBSERVATIONS.

Having instituted a series of novel experiments—at least I conceive them to be new—and having now laid a portion of them before the Public, especially the medical community, accompanied with an earnest solicitation that they may condescendingly test their accuracy, with the exercise of all the candour and kindness which they are wont to bestow upon persevering efforts at improvement, however feeble may be the power exercised, I proceed at once to a cursory review of them, and conclude this section of my work by venturing to draw some inferences; but as I contemplate appearing again on this subject before the Public, I deem it prudent to premise, that, while I aspire to the honour of favorable notice by accumulating and placing upon record physiological *facts* as developed by patient and intricate research, I earnestly hope that I may not be seduced into a train of speculative deductions.

I am not unaware that if, by the dint of accidental good fortune, application, and a little tact, I should succeed in raising a few buried truths to the light of day, my inferences from those facts may be erroneous and worthless, and therefore it will be my policy to leave hypotheses for the speculation and risk of others.

Remarks on Experiment I.—All physiologists of the present and of the last century with one accord have referred to the *coagulating* property of the blood as one of its most interesting attributes.

They have always found, that upon blood being spilled from the vessels of a healthy animal, whether from artery or vein, it has quickly assumed a solid form. When, actuated by the spirit of experimental inquiry, they have imprisoned the blood of the living animal within the large trunks, either of arteries or veins, between two ligatures, and after the lapse of three or four hours, upon slitting them open, they have invariably found the blood coagulated, and of a dark colour (vide Hunter, Sir Astley Cooper, Majendie, and others). But when

I lay bare the carotid artery of a living animal, availing myself of the aid of peculiar machinery, and *isolate* about two inches of the vessel, with its contents, *instantaneously*, and thereby catch the containing fluid flying or in its transit, and, after allowing it to remain quiescent in a temperature of sixty degrees for three or four hours, then slit the vessel open, what do I find—a fluid? Yes. Is it blood? I do not know;—it appears to the eye like condensed steam or vapour of a bright red hue, extremely thin and transparent; the colouring particles gravitate, and a limpid fluid floats on them; not a particle of coagulum is to be seen nor detected hours afterwards; the red particles adhere tenaciously to the dish, but the delicate fluid evaporates rather quickly.

To account for this difference in the results of the two operations physiologically in all their bearings would, I conceive, be no easy task. For my own part, I shall not pretend to it until I have been enlightened by adopting the same course of exploration through the venous system as that which I have just described with the arterial.

The veins I have experimented upon with the apparatus only in part.

With regard to the *trunks of veins*, in the present stage of the inquiry, I have not sufficient confidence to report progress, although I am exceedingly sanguine as to the result of future investigation upon the foregoing principles.

The Experiments II and III are merely confirmatory of the first ; but Experiments IV and V I imagine are pregnant with matter soliciting deep and serious reflection.

It will be seen, that I contrived with my apparatus to strangle the testicle of a vigorous horse by the instantaneous gripe of the instrument upon the spermatic chord, preserving, at the same time, the perfect integrity of the gland and its adjacent parts. It was isolated, dead ; but allowed to remain attached to the animal for twelve hours after the operation, when it was removed by a pair of scissors.

It was my design, in conducting this experimental operation, besides effecting the *sudden* stoppage of the arterial and venous systems through-

out the organ, also to effectually retain within the vascular tissues the full quantum of the blood's *gas* or *steam*, as well as the blood itself, which naturally and properly belonged to the detached testicle; and I think I perfectly succeeded.

I am quite aware of the exclamation this must call forth! What can this writer mean by his “blood's *gas* or *steam*?” I answer, fearlessly and and without reserve, that I believe the present generation of philosophers are doomed to the humiliating task of retracing the steps of the ancients upon more important points than one vitally connected with the animal-economy.

Those of the very old school have reiterated that no perforation, however small, can be effected in a living bloodvessel without the *instantaneous extrication of vital air*; and they go on to say, that that the escape of the blood, which is so evident to our optics, is a necessary sequence of the communication thus opened between the vessel and the atmospheric air.

I have been brought up legitimately in the new school, but by a long persistence in experimental

inquiry, I am constrained thereby to go over to the old school, as regards the physiology of the blood.

Not unmindful of the impotency of these remarks of mine, unless supported by *proof*, I hasten to avow, that in my next Essay I expect to substantiate them chiefly upon the practical basis of absolute demonstration, relying upon theory only as an auxiliary, and in nowise admitting it except as collateral evidence.

By hermetically sealing the trunks of bloodvessels at the instant a gland or any distinct organ is isolated from the rest of the living animal, as, for instance, the testicle, tail, head, or penis, I imagine that, besides securing the whole of the blood in its proper vessels, the *halitus* is also preserved. In no other way can I at present account for the blood retaining its perfect fluidity after the lapse of twenty-four hours from its death, as illustrated in Experiment IV of the horse's strangled testicle.

This result suggested to me the necessity of Experiment V, the amputation of the tail of a

horse high up towards its root, which is instantaneously effected by the common method of operating. It will be remembered that, although every drop of blood was preserved within the vessels of the detached member, no provision in this case was made for the detention of the *halitus*, or *blood's gas*.

Did an anxious inspection of the contents of the vascular trunks of this dead tail furnish products corresponding with the vessels of the dead testicle? By no means: they agreed only as containing blood; but mark well how they disagreed: in a much less space of time after the amputation than in the preceding experiment, the blood was found *firmly coagulated within its vessels*.

On the contrary, with the testicle I had to trace the vascular canals throughout their ramifications to obtain even small clots of congealed blood, such as would lodge upon a pin's head; while, on the other hand, with the amputated tail, I was spared all trouble of dissection, for by merely applying the forceps to the mouth of each trunk, I not only seized a clot, but its tenacity was so great

that shreds, amounting to two inches in length, of coagulated blood were withdrawn; and further, each portion of this blood was in a state of solidity, and appeared to correspond exactly, as to shape and volume, with the calibre of its vessel. I mean to assert broadly, that the application of the Hunterian theory of the *vitality* of the blood will not reconcile these differences.

I have as yet limited the description of the application of my new apparatus for testing the contents of the trunks of living bloodvessels *to the arteries only*, though its use has also been extended to the jugular veins; but I feel very considerable hesitation at present in reporting progress thereon: enough, however, has transpired to warrant me in prosecuting these experiments much farther, particularly as regards the venous system.

Before I dare to give utterance to all that I have already collected affecting the stability of the Harveian doctrine of the *circulation* of the blood, I must be allowed time and opportunity to extend my *experimental inquiry*, as the reader will

remember I profess to despise conjecture or hypothesis upon a subject paramount in importance to every other connected with the organization and laws of animal life.

In order to carry these views out, whether successful or not in the issue, I regret to add, that the Vena Cava, anterior or posterior, or both, of a large-sized living animal must be embraced by the new instrument—perhaps the heart itself.

I intend that some early number of the *Register* shall be provided with an Engraving representing the construction of my new apparatus.

In quitting the chronicling part of this subject for a short season, in order to return more vigorously to its practical part, I shall avail myself of the opportunity it presents of addressing a very few words to the brethren of my own subordinate though important profession, having commenced my Essay by an appeal to all the charitable and best feelings of the members of the elder science in behalf of these humble efforts.

I am forcibly struck with the idea, that my veterinary compeers are the men most likely, in the

end, to bring to bear a refutation or confirmation of the views herein advanced with reference to the blood, notwithstanding a perfect willingness on my own part to succumb to the predominant attainments of the members of the elder science, supposing zeal and application upon equality between the two classes.

The superior eligibility of the veterinarian will consist in the facilities which every succeeding day will afford him of testing, in a variety of ways, the new points which I have ventured to broach; still pursuing his ordinary avocations, in his natural element, and within his accustomed sphere of action. Not so easy, however, with the medical man, who takes up the subject honestly and zealously.

He must make his mind up to encounter at the onset an assemblage of vexatious circumstances, viz. the sacrifice of his valuable time and money, and must even procure veterinary assistance, to furnish the tact necessary for surgically operating upon very *large* animals; and I shall conclude by offering my opinion, that the carrying out of

these researches upon cold-blooded animals, or on any animals of *very small* dimensions, will be futile.

Part II will be devoted to the consideration of the Venous System, with the narration of numerous experiments.

